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A Graphical User Interface Design for Shipboard Damage Control

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The Damage Control Information Display System (DCIDS) is a graphical information-retrieval and equipment-control system that gives shipboard damage control personnel the ability to detect, analyze, and combat various types of damage control situations. This report presents a method of displaying information from shipboard damage control sensors graphically and using the graphical display for operator control of selected equipment and system functions. Special consideration for the intended users' lack of computer experience has led to a novel technique for providing easily recognized graphical cues for distinguishing graphical control structures from informational displays. The careful use of shading and positioning of graphics is used to create a three-dimensional appearance and apparent motion for the controls, while information-only displays are drawn in a featureless two-dimensional plane. The DCIDS graphical user interface can improve the performance of damage control personnel through the use of intuitive, easy to use graphical displays and controls.

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CONTENTS

A GRAPHICAL USER INTERFACE DESIGN FOR SHIPBOARD DAMAGE CONTROL

INTRODUCTION

The combat effectiveness and survivability of Navy ships are directly affected by the ability of the vessel to detect, analyze, report, and control the effects of damage from either accident or hostile action. To respond quickly to results of various kinds of damage, it is important that the information from the damage control sensors be presented in a way that helps damage control personnel make a quick and accurate assessment of the nature and extent of the damage. This report presents a method of displaying information from shipboard damage control sensors graphically and using the graphical display for operator control of selected equipment and system functions.

BACKGROUND

Shipboard damage control systems use sensors, equipment, material, and techniques to control damage associated with fire, flooding, hull damage, and chemical, biological, and radiological warfare. Historically, most sensors were connected to alarm systems that operated locally or through point-to-point connections to Damage Control Central or one of the ship's Repair Stations. Damage control requirements of the future will render dedicated alarms obsolete, as the number and sophistication of sensors increases.

The newest ships in the Navy have nearly 800 smoke, heat, flame, and flood sensors [1]. Damage control sensor technology is evolving at a rapid pace with more complex and numerous measurements being taken from more locations throughout the ship. Future damage control (DC) systems will monitor every compartment on a ship for fire, flooding, and toxic gases [2] and will have remotely reconfigurable sensors with fire classification and water and air flow monitoring capabilities. Chemical, biological, and radiation (CBR) warfare agents will be monitored in collective protection zones throughout the ship. Hull, mechanical, and electrical (HM&E) resources will be monitored and remotely controlled along with the fire mains and ventilation systems. The next generation of sensor technology will provide a continuous indication of the magnitude and rate of change of the data being measured, resulting in an extremely large amount of information that must be processed to get an accurate indication of the extent of damage in any situation. Without a properly designed user interface for this complex system, the amount of data being collected will overwhelm the DC operators, resulting in reduced operational readiness or loss of the vessel.

The Damage Control Information Display System (DCIDS) is a graphical information retrieval and equipment control system that is designed to be used in a network environment of remotely controlled sensors, detectors, information resources, and communication equipment. The goal of this system is to provide the damage control assistant (DCA) with the ability to detect, analyze, and combat any type of shipboard damage situation. Computer based decision aids will also be used, where appropriate, to provide recommendations or automated functions to reduce the workload of the damage control personnel. By

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using a networked system of sensors, data multiplexers, and workstations, an integrated reconfigurable flexible system is created that allows the DCIDS to be operated anywhere on the ship where access to the network exists.

The DCIDS is an experimental prototype that is currently in the exploratory development stage. Funding for this phase is provided through the Damage Control Project of the Surface Ship Technology block from the Navy Technology Center for Safety and Survivability (NRL Code 6180). Further development of the implementation, interface requirements, and transition to fleet use are planned.

USER INTERFACE CONSIDERATIONS

Shipboard damage situations often involve multiple compartments or large areas of the ship. Damage control parties must have a good way of visualizing the affected areas and the adjacent areas that are threatened. The best way to display this information is pictorially by using a high resolution, large screen color display. A large monitor allows deck plans to be presented at a small enough scale to permit the length of the ship to be seen on the display without having the sensor information being too small to be discernable. Color is used throughout to produce familiar status signals such as red, yellow, and green indicators as well as to help highlight significant information or clarify the presentation of new information. The figures in this report are gray scale renditions of screen images and do not accurately reproduce the appearance of the actual DCIDS displays.

Intended Users

Since a quick response is needed in damage control situations, it is necessary to present sensor and alarm information in an informative but concise way. It is also important that damage control personnel be able to take quick action to initiate corrective measures against any damage situation. The design of an effective graphical user interface involves not only the display of data, but it includes the meaningful representation of the information, the methods of presenting it to the operator, and the mechanisms the operator uses to manipulate the interface to perform his tasks.

Because computer workstations have good computing power, networking abilities, and graphics display capabilities, they are obvious targets for the implementation of the DCIDS. However, users of the DCIDS are not typical computer users. For this reason, special consideration has been given to the human factors aspects of the user interface. Display symbology and input procedures and techniques that are familiar to computer users are not considered necessary or even desirable in some situations. Standards for the display of buttons, check boxes, pull-down menus, and other graphical devices are generally not very useful in this type of environment. Our approach has been to try to present information to the operator in an obvious, uncomplicated way and to give definitive visual cues for graphical devices that allow him to initiate some type of action.

Different types of computer workstations use different types of pointing devices and selection buttons. To prevent accidental use of the wrong button in a crisis situation, all graphical controls in the DCIDS use a single button interface. In implementations where multiple buttons are present, only the left button is functional. The choice of a pointing device seems to be one of user preference, since most mouse devices also have an equivalent trackball device. A trackball would be more appropriate in a shipboard environment, since it could be secured to a fixed location to prevent its loss in rough seas, but a mouse would function equally well under normal circumstances. A touch screen could also be used, but accidental bumping or leaning against the screen could produce disastrous results; therefore its use is not recommended.

Certain standard graphical input techniques are used with the DCIDS, and their definitions are given here for clarity. References to the *pointer button* mean the button located on the pointer device (i.e., the mouse or trackball button). Graphical control buttons displayed on the screen are usually referred to simply as *buttons*. *Pointing at* refers to simply positioning the on-screen pointer at the desired location without performing any pointer button action. *Clicking* consists of positioning the on-screen pointer at the desired location, then pressing and releasing the pointer button. *Double-clicking* consists of positioning the on-screen pointer at the desired location, then pressing and releasing the pointer button twice in rapid succession. *Dragging* consists of positioning the on-screen pointer at the desired location, pressing the pointer button, and moving the pointer to a new location while holding the pointer button down. Most DCIDS actions require only clicking.

Distinguishing Graphical Data from Graphical Controls

The DCIDS displays graphical data and graphical control devices simultaneously on the screen. Controls are disbursed on the screen since they are placed in appropriate locations on the ship's deck plans. Without an easy way to distinguish controllable items from uncontrollable items, the operator may waste precious time trying to perform functions on the wrong part of the display or unknowingly cause unintended actions. Many types of standard shipboard equipment have both an information display and some type of control mechanism. Typical equipment controls are pushbuttons or knobs that protrude from the face of the equipment, while data displays are usually flush with the front panel. The DCIDS uses shading techniques to simulate a three-dimensional (3-D) panel. Data are displayed without shading and appear to be "flat" on the screen. Controls are drawn with shading to give the appearance of three dimensions. The convention used in the DCIDS for shading is that the light appears to come from the upper left of the screen. This causes the top and left sides of raised controls to be lighter shades and the bottom and right sides to be darker. Controls that are recessed use dark shading on the upper left and light shading on the lower right; the face of the control is darker, thus giving the impression that the control is farther away. Labels on recessed controls are black in color, while raised controls use a dark gray color. Figure 1 shows the appearance of data and controls as they would appear on the DCIDS screen. Most of the text on the figure represents data while the *Open* and *Close* buttons on the right represent typical rectangular push-button controls.

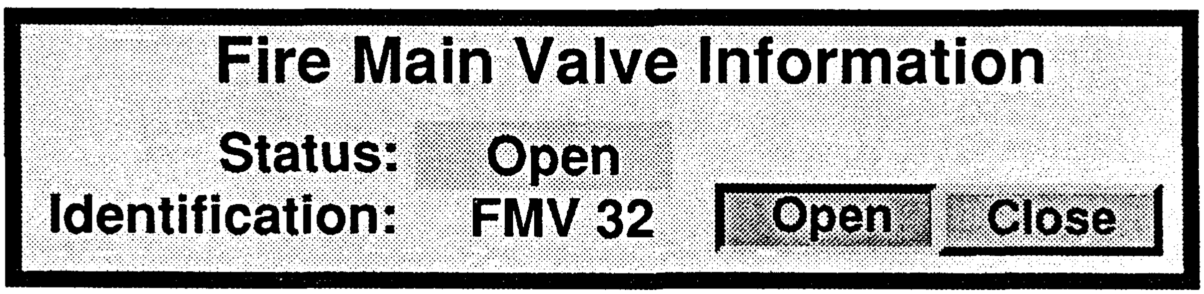

Fig. 1 – Graphical data are displayed with a "flat" appearance while graphical controls use shading to produce a 3-D look

To simulate the action of push buttons, animation is used to give visual feedback to the operator. This animation is performed by replacing the raised button graphic with the recessed button graphic when the operator clicks on the control. Special attention has been placed on the position of the text on the recessed and raised buttons. By shifting the location of the recessed text very slightly to the right and down relative to the raised text, apparent motion of the button is perceived. This positional shift of the text along with the change in shading as described above produces a very convincing and familiar appearance of the button being pressed.

The animation also tracks the position of the pointer to allow the operator to change his mind before an action is completed. This is accomplished by making the button appear recessed only while the pointer is positioned directly over the control. If the user changes his mind about operating the control after he has already pressed the button, he simply moves the pointer away from the control before releasing the button, thus causing the control to appear to *pop back* to its original position.

The apparent motion of controls is also used to indicate partial completion of the desired task. When a control state is altered by the action of another control, the altered state is not shown until the action is completed. For example, if the operator clicks the *Close* button in Fig. 1, both the *Open* and *Close* buttons appear recessed momentarily. After the valve closure function is performed, the state of the *Open* button is changed and it appears to pop up. When two contradictory buttons appear to be down, the action that causes the state to change from one to the other has not reached completion.

The graphical symbols used to represent valves, gauges, detectors, and sensors are kept as simple as possible. A forced adherence to standard damage control symbology is not practical because the resolution of the display monitor cannot support the detail required in some symbols. Color is used as the cue to reflect the equipment status, usually by using the familiar red, yellow, and green representations. For example, the DCIDS uses green and red circular pushbuttons to represent open and closed fire main valves. The circled-X and circled-X-with-black-dot symbols that are sometimes used are very difficult to distinguish on the screen unless they are large enough to be obtrusive. When multiple types of detectors are required, simple geometric shapes such as circles, squares, and diamonds are used to provide easy differentiation.

The method of presenting text to the operator has also been carefully considered. Typefaces or fonts that are easy to read from graphics monitors are used. Large type sizes and background color highlight are used to show information that the operator needs to respond to quickly, but smaller fonts with no highlighting are used for less important information. Mixed upper and lower case letters are used throughout. This is a departure from standard shipboard reporting mechanisms, but tests have shown [3] that text printed in all upper case is read 14% to 20% slower that text in lower case. Acronyms and abbreviations that use all capital letters will naturally be preserved.

DESIGN APPROACH

Full screen displays on a large color monitor are used to provide a good ship-wide overview of damage control information and controls. Selection of views of alternate decks or detectors is performed through simple point and click actions on a screen selection control panel and deck selection control buttons. Individual detectors and controls are shown in their correct ship location and are drawn as 3-D graphical controls that provide detailed information on pop-up panels when requested by operator action. The panels are placed in unobtrusive locations on the screen with reference arrows showing the location of the sensor. These panels also provide remote control and reconfiguration capabilities for the individual components through graphical controls.

Main Display Screens

The DCIDS prototype uses two main screen formats for displaying the detectors and fire mains information. Figure 2 shows the combination profile/plan view used for the detectors screen. The profile view of the ship on the lower portion of the screen has the selected deck highlighted, and above it the plan view of the deck shows the locations of various detectors. This technique is used because the number of detectors is large and viewing only one deck at a time prevents the display from becoming cluttered. Figure 3 shows the display format used on the fire mains screen. The fire mains system is simple enough

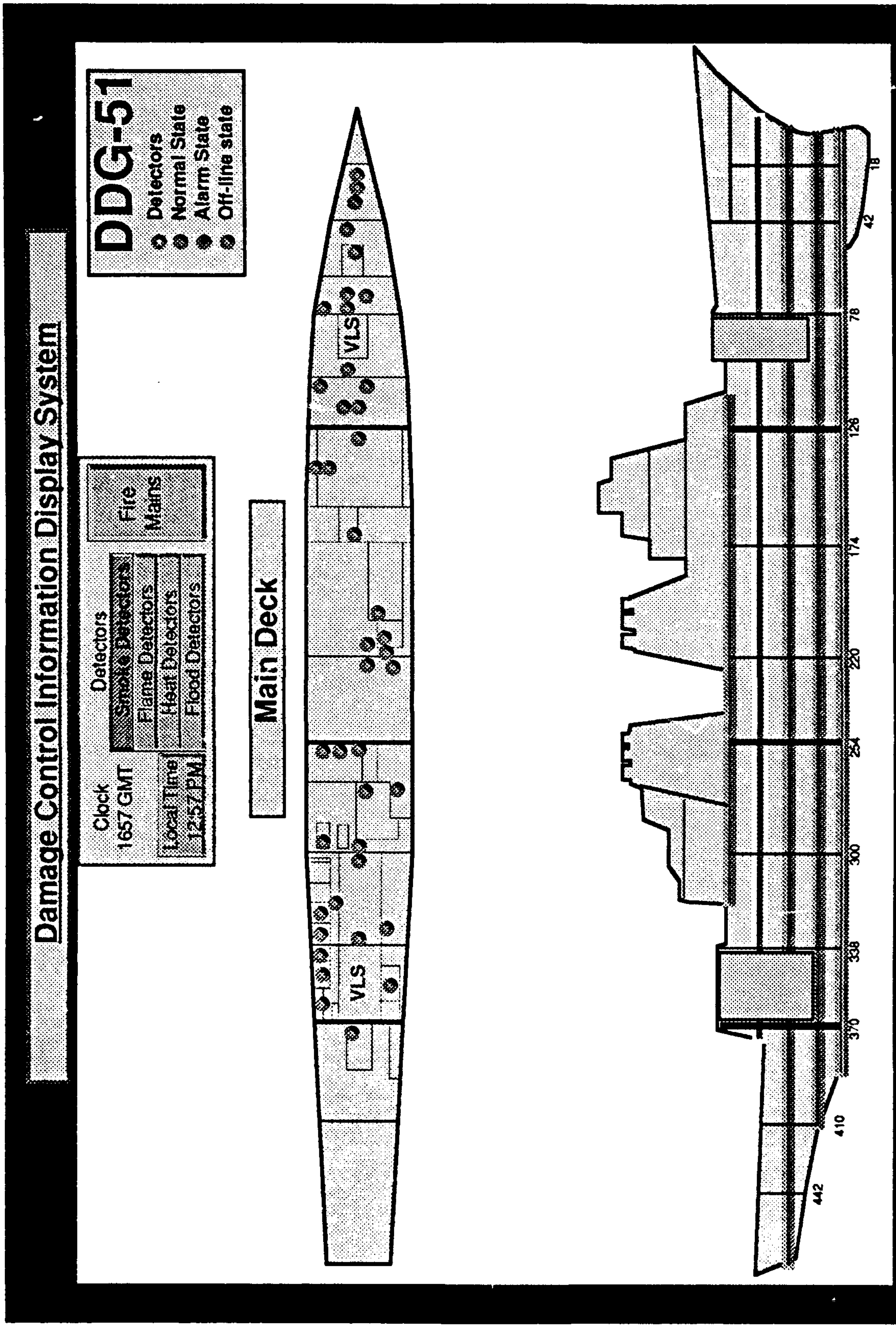

Fig. 2 – The detectors screen shows the profile view of the ship with the selected deck highlighted along with the plan view showing the locations of various sensors

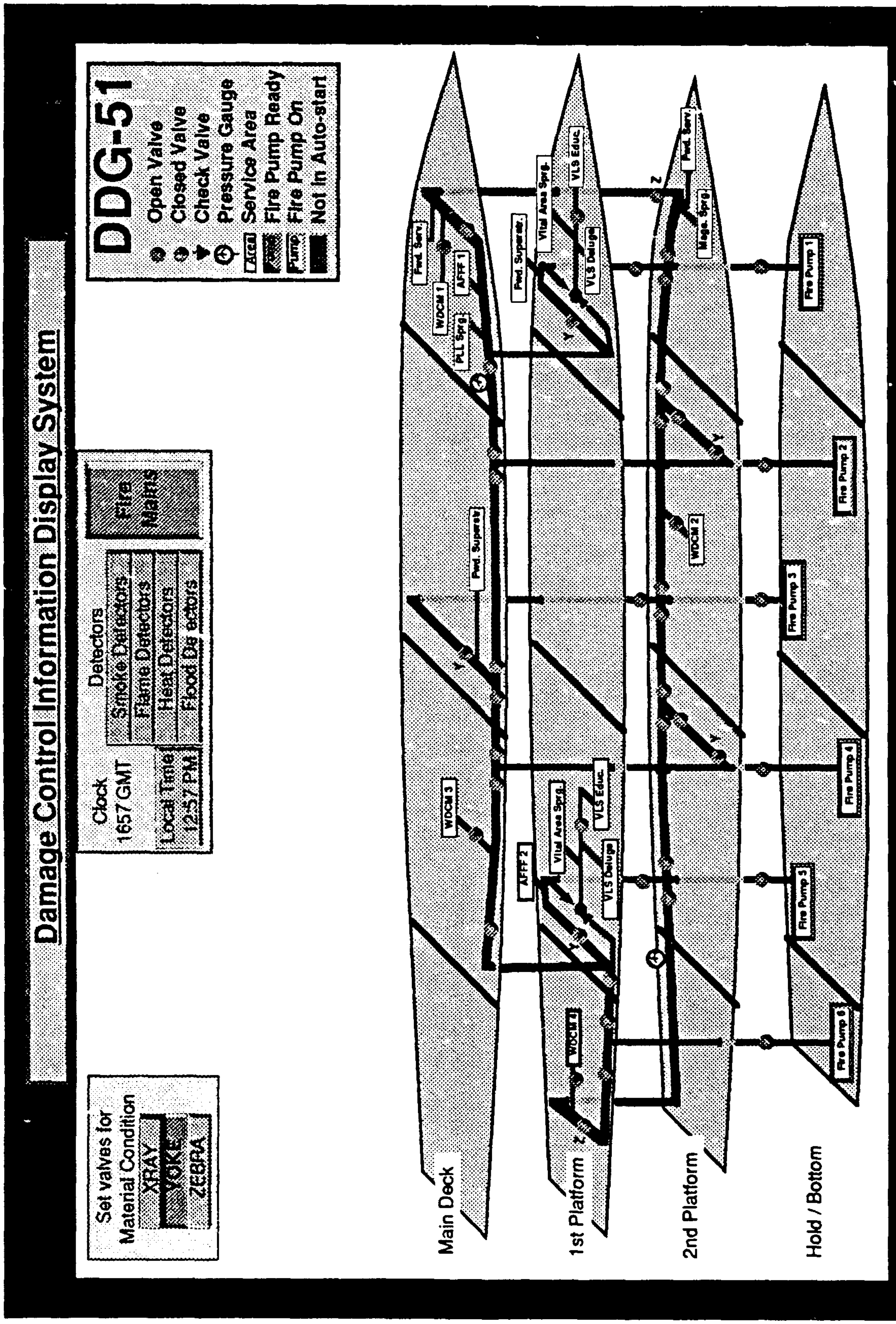

Fig. 3 – The fire mains screen shows a 3-D cut-away view of the four decks that comprise the fire mains system

to be shown entirely on a single screen. Because various aspects of the system are located on both sides of the ship and on different decks, a cutaway view of the ship is used. Only the decks that are used with the fire mains and fire pumps are shown thus providing a concise but complete display.

Screen Selector Control Panel

A small screen selector control panel that is always visible on the display is used to select either the fire mains screen or one of the detectors screens. To select the fire mains screen, the operator clicks the button labeled *Fire Mains* on the right side of the panel. To select a detector screen, the operator clicks on the button in the center of the panel for the type of detector (smoke, flame, heat, or flood) of interest. Visual feedback of the selected function is provided with 3-D animation and shading techniques as described earlier. The button for the selected screen appears recessed and all other buttons appear to protrude, thus providing the operator with an indication of which screen he is viewing. Figure 4 shows the display control panel as it would appear when the smoke detectors screen is displayed.

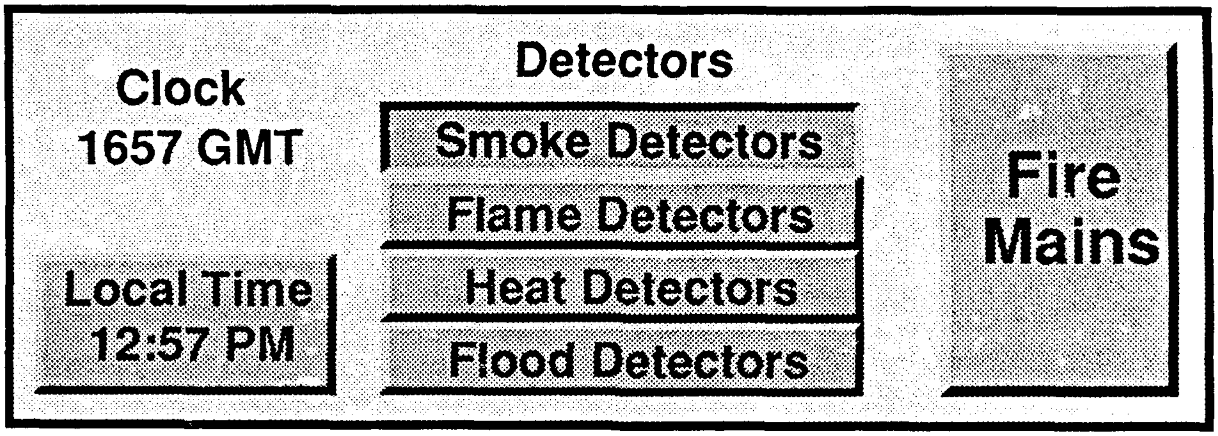

Fig. 4 – The screen selector control panel is used to select various detector screens or the fire mains screen

The panel also has both a universal time (Greenwich Mean Time) display and a controllable local time display. The local time display can be changed by clicking on the Local Time button. This causes the local time control panel shown in Fig. 5 to appear, thus enabling the operator to set the time with simple button operations.

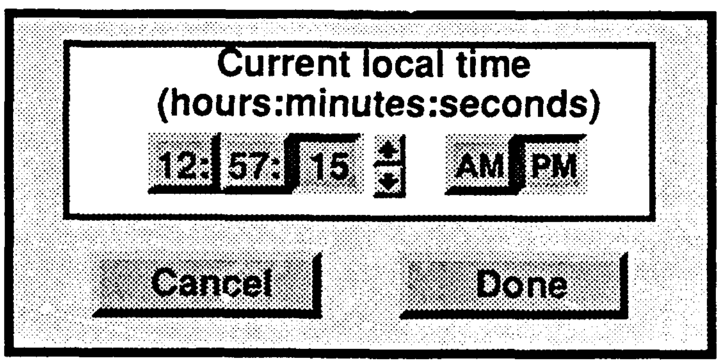

Fig. 5 – The local time control panel allows the operator to set the local time display by simply clicking on the appropriate buttons

Detectors Screen

A combined plan/profile screen is used to view the smoke, flame, heat, and flood detectors. The profile view of the ship on the lower portion of the screen is displayed with the selected deck highlighted, and above it the plan view of the deck shows the locations of various detectors. Each detector type is viewed separately by clicking the button for the detectors of interest on the screen selector panel. As the operator switches between different detector types, the plan view changes to show the locations of the appropriate detectors, and the legend in the upper right corner of the screen also changes to reflect the new information. When changing between the various detector types, the deck plans appear to be stationary with the detectors being shown using different overlays. Because of the large number of detectors, it is not feasible to display multiple detector types simultaneously. Selection of one detector type removes the display of another detector type, thus eliminating unnecessary clutter.

Plan Views of Detectors

A plan view of each deck is provided in the upper portion of the screen showing the locations of the various compartments. The watertight bulkheads that serve as fire protection zone (FPZ) boundaries are drawn with heavy lines for easy reference. The locations of all detectors of the selected type on a chosen deck are overlaid on the deck plan. To view the detailed information on any particular detector, the operator simply clicks on its graphical symbol. Figure 6 shows the animation of the button motion that is followed by the appearance of a pop-up panel that displays the detailed information. An arrow from the pop-up panel to the detector location gives the operator an easy reference to the detector location. The amount and type of information presented depends on the capabilities of the particular detector and will generally include a status indication, the compartment name and location, and detector-specific details. Current detectors generally have only a fixed pass/fail type of threshold detection with little or no remote control capability, but the more advanced devices currently under development will provide more detailed information and will have adjustable controls.

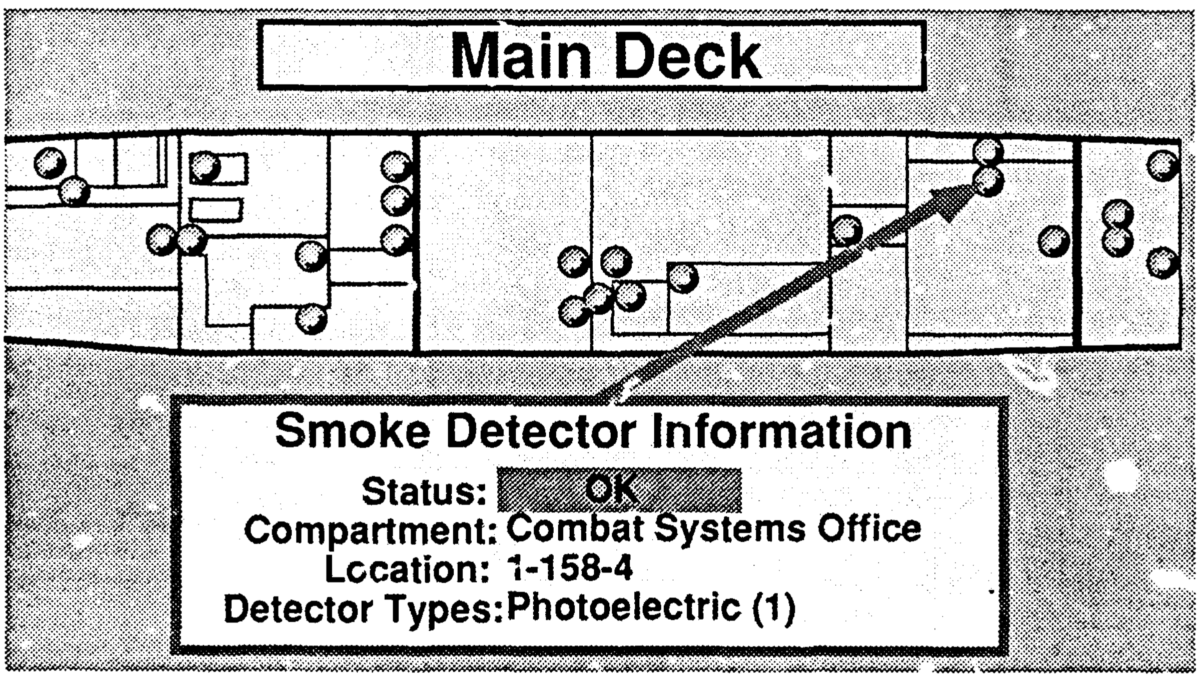

Fig. 6 – Pop-up panels are used to show detailed information and the reference location of any detector

Advanced sensors and detectors will require additional graphical controls for enabling or disabling features as well as setting variable parameters. Figure 7 shows how the detailed information panel for an advanced heat detector with an alarm enable function and variable alarm threshold might appear. The *Enable Alarm* check box is operated by simply clicking on the box to show (or hide) the check mark. The alarm is enabled when the check mark is visible, and it is disabled when the check mark is not shown. The variable threshold setting for the alarm is adjusted with the slider on the right of the panel. The slider uses coloring to show the alarm and normal ranges. The normal range in the figure is 80° to 105° and the slider is colored green in this area. The alarm range is 105° to 190° and is colored red. The slider is variable over the range of the indicator (80° to 190° in this example) and is operated by dragging the slider button to the desired value. The numerical display of the alarm setting (*Alarm at 105°*) tracks the action of the slider so that the operator has an easy control mechanism but can set the alarm to a precise value. The current reading from the detector is displayed as a numerical value and graphically on the slider to give a quick indication of the relative difference between the current value and the alarm threshold. This method of using a pop-up panel with various numbers and types of buttons, check boxes, sliders, and other control mechanisms will be used with more advanced detectors to provide a consistent user interface.

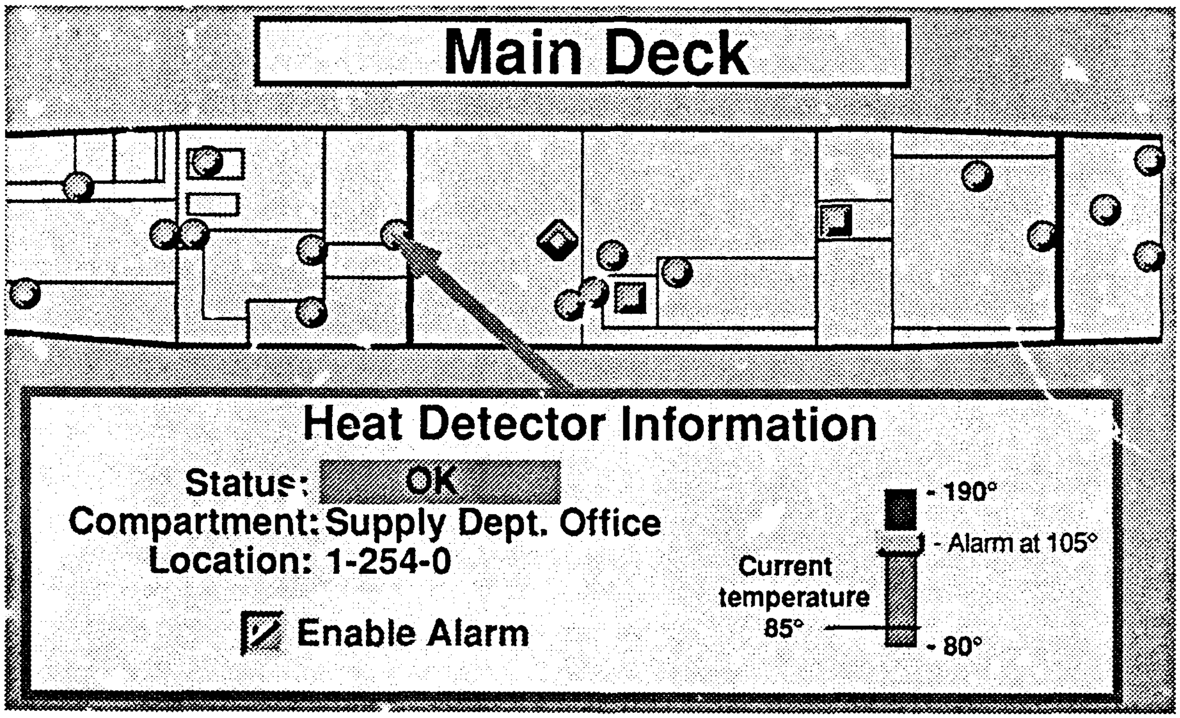

Fig. 7 – Advanced detectors such as this reconfigurable heat detector will have adjustable controls and present more detailed monitoring information by using the same basic graphical techniques

While viewing the details of any particular detector, the operator simply clicks on any other detector's graphical symbol to view its detailed information. The information for the new detector replaces the information for the previous detector and the arrow points at the new detector's location. Only one pop-up panel is displayed at a time to prevent the clutter associated with using a separate panel for each detector. Clicking on any part of the screen that is not a graphical control causes the pop-up panel to be removed from the screen.

The color of the detector symbol reflects its current status. Detectors that are operational and are in their normal state are colored green, detectors in the alarm state are colored red, and a cautionary status is yellow. If the detector is not responding to queries from the system, it is considered to be off-line, and its

symbol is colored orange. The color highlighting of the status word in the detailed information panel (when visible) matches the color of the detector symbol.

Profile View of Selected Deck Number

The lower half of the detectors screen shows a profile view of the ship with a 3-D deck selector button for each deck. Because these buttons run the length of the deck, they have the appearance of a long horizontal bar rather than a button, but they function as buttons. They allow the operator to change the plan view on the upper portion of the screen to the appropriate deck to view the locations of the detectors on that deck. The current deck selector button remains highlighted to show the selected deck's relative location. A label above the plan view also indicates which deck is currently being viewed.

The profile view shows the locations of watertight bulkheads and FPZ boundaries in a way similar to the method used with the plan view. Each watertight bulkhead is shown as a vertical line with the frame number printed below it, and the FPZ boundaries are displayed by using wide lines for added emphasis.

Fire Mains Screen

The fire mains system has less information to present to the operator, therefore a more compact display format is used, as shown in Figure 3. Using a cut-away view of only the decks of interest, a single screen is used to display the entire fire mains system. The layout of the fire main pipes is shown graphically as a solid blue line traversing the appropriate decks and compartments. Dark lines are used to show where the pipes are above decks, and pale lines show where they pass below decks. FPZ boundaries are drawn with wide black lines (as on the detectors screen) to provide an easy visual reference. A legend is given in the upper right corner of the screen to aid in distinguishing the items on the display.

The remotely controlled fire main gate valves are shown as simple color-coded buttons. Open valves are green; closed valves are red. The same pop-up panel technique that is used to show detector information is used to show fire main valve details. The panel, shown in Figure 8, provides valve status information and has graphical controls for valve operation. The valve status is highlighted in the appropriate color, and an arrow is used to indicate the valve whose information is displayed. The control buttons reflect the current state of the valve, and only the appropriate button is functional (i.e., if the valve is open, only the *Close* button is functional). This display/control technique is consistent with the appearance and operation of the detectors screen by providing a familiar user interface design.

Simple arrow symbols are used to show check valves, since they convey the idea of one-way flow. Check valves are used in certain areas of the ship to allow service from either the port or starboard fire main while preventing cross flow between the mains. Areas serviced by the fire mains are shown as simple boxes labeled with the name of the area. Connections between the service areas and the fire mains are shown graphically to let the operator quickly asses the impact of opening and closing valves. To provide a complete and informative picture of the fire mains system, some of the service areas are shown slightly offset from their actual positions. This is done to eliminate the crossing of lines on the display, but the relative locations of service area connections to the fire mains have been preserved.

Pressure gauges are shown graphically as small 3-D dial faces and are positioned on the deck plans at their appropriate locations. Clicking on a pressure gauge causes a detailed information panel to appear that shows the current alarm and pressure gauge status, as shown in Figure 9. Note that the pressure gauges have more detailed information and controls and require a larger panel, but the method of presenting information, enabling functions, and performing commands remains familiar and consistent.

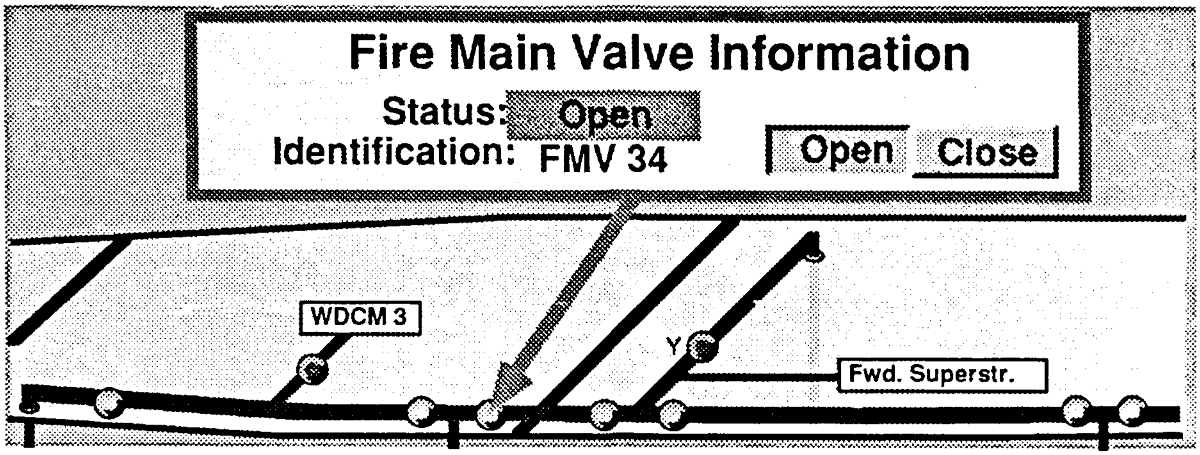

Fig. 8 – The fire mains screen uses same graphical control techniques and detailed information panel for a consistent user interface design

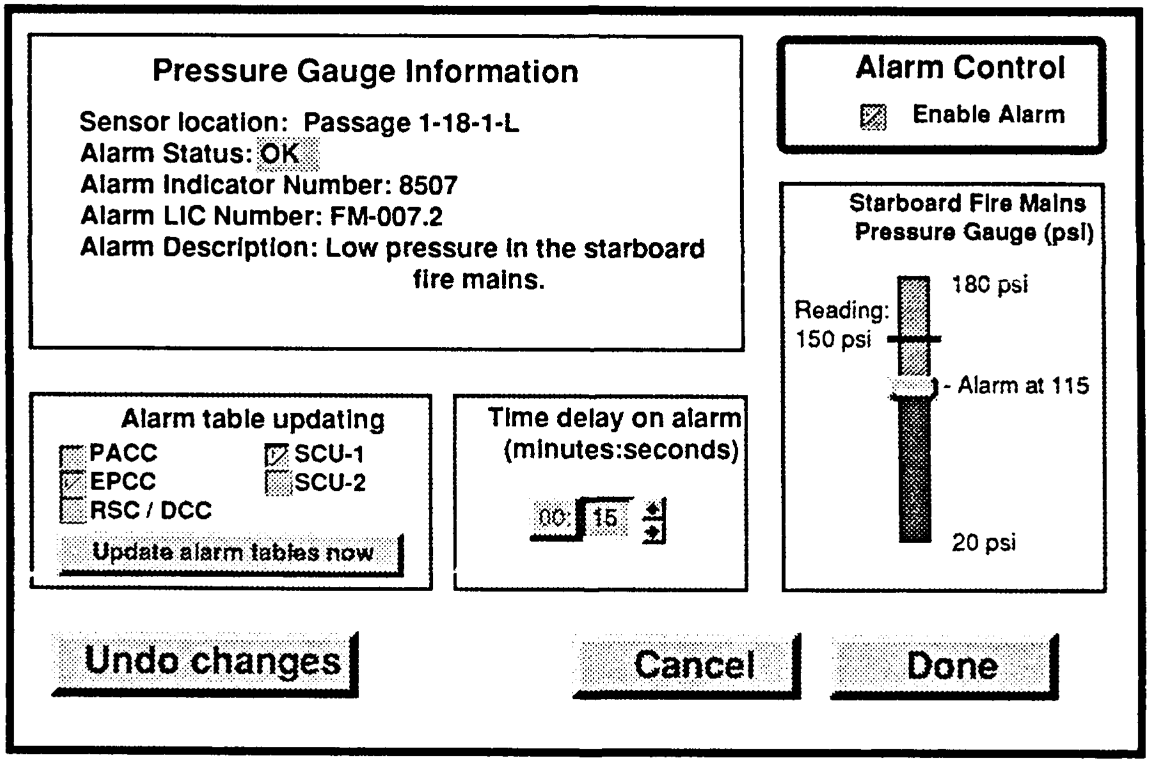

Fig. 9 – The detailed information panel for the fire main pressure gauges has more information and controls, but it reflects the consistent user interface design

Alarm Reporting

Displaying alarms is a major consideration in any damage control display system. The DCIDS uses multiple screens with views limited to specific types of detectors, so all alarms cannot be viewed simultaneously. Because the detector that causes an alarm may not be displayed on the current screen, a way to alert the operator to the alarm condition is required. Both audible and visual alarms are used to get

the operator's attention. A repeating beep sound is used for the audible alarm, and flashing indicators are used for visual attention. The audio/visual alarm is started by any detector alarm and stops when the operator clicks on any detector on the screen that is causing an alarm. This technique allows the operator to cancel the audio/visual alerts when any one of a group of alarms is responded to, as may occur as a result of a major explosion or conflagration. It avoids the problem of having to repeatedly cancel individual alarms. If any additional alarms occur between the time of the first alarm and the operator's response, they are included in the group alarm and do not require additional actions by the operator. Subsequent alarms that occur after the operator has responded do trigger the audio/visual alarm indicators again. Any alarms that are visible on the same screen are combined into a group, but alarms on other screens are not cancelled until that screen is visible.

When a detector causing an alarm condition is visible on the plan view of the current screen, the detector's graphic symbol flashes. As other detectors on the current screen reach an alarm state, their symbols also flash. An additional indication is given to the operator by also flashing the compartment area on the profile view, which allows the operator to see the extent of damage between decks, if necessary. Figure 10 is a pictorial of the flashing indicators that would be active when smoke detector alarms in three compartments on two different decks are active. The indicators for the current deck stop flashing when the operator clicks on any of the flashing objects. Clicking on the detectors or compartments for this deck is an acknowledgement of the alarms, and the detailed information panel is displayed to give the operator the specifics of the particular detector. Clicking on the flashing compartment on the lower deck acknowledges this deck's alarms, and then display the lower deck's screen.

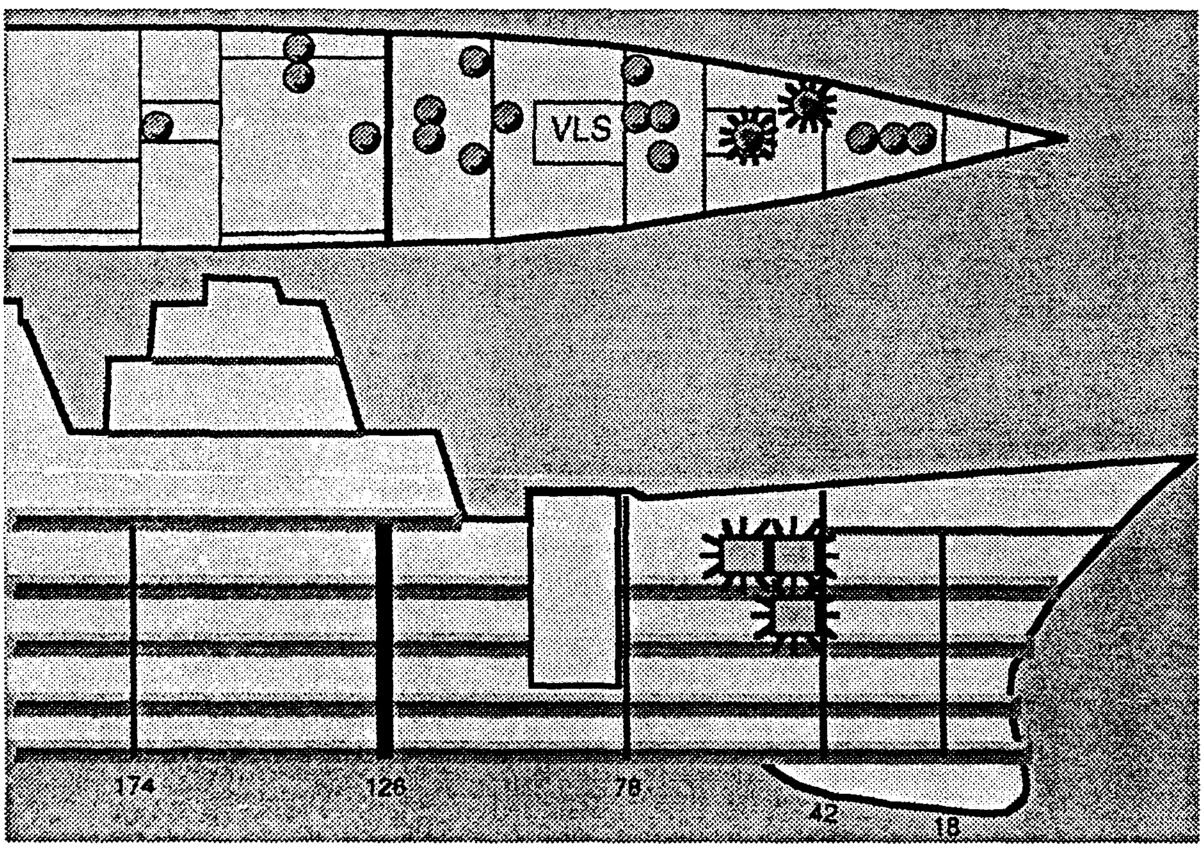

Fig. 10 – Alarm indicators flash for the individual detectors and the compartments in which they are located to give a multiple-deck and multiple-compartment overview of the affected area

It is also possible for multiple types of detectors to be in an alarm state at the same time. Since the DCIDS displays only one type of alarm on the screen, the screen selector panel is used to show alarms from multiple types of detectors. This would be a necessary feature since, for example, it would be very likely that smoke, heat, and flame detectors would all go into an alarm state in an actual fire. The screen selector panel shows an alarm state by flashing the appropriate button for the detector type. Figure 11 shows the appearance of the screen detector panel while viewing the smoke detector screen when heat detectors are in an alarm state. Multiple detector types that are in an alarm state would cause multiple buttons to flash.

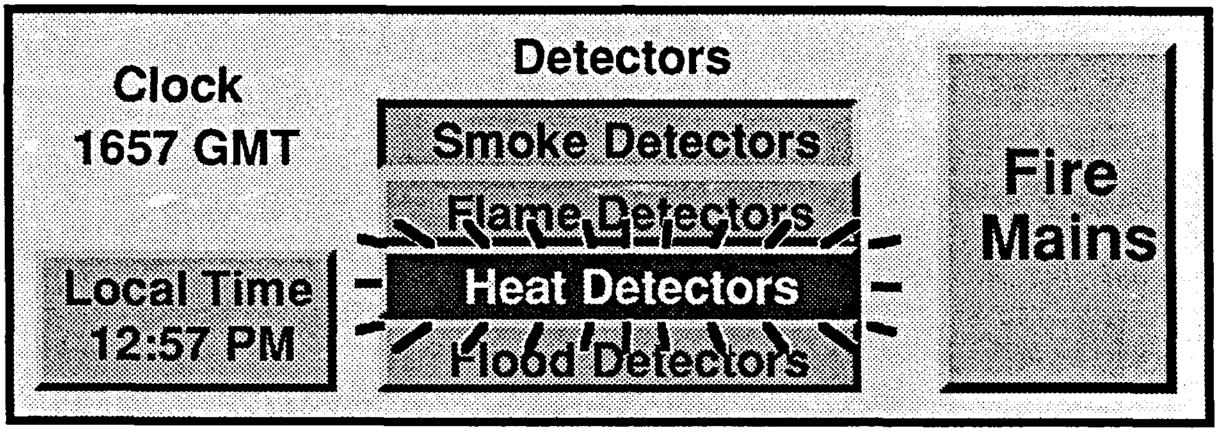

Fig. 11 – The buttons on the screen selector panel flash to show that alarm conditions exist on other screens

DCIDS Prototype Implementation

The DCIDS prototype model has been implemented on a Macintosh II computer with a 19 in. color monitor that has a 1024 by 768 pixel resolution and 256 colors. This provides the large screen area required to display deck plans and sufficient resolution to include the necessary details for small symbols. The color palette is large enough to display a variety of colors and shading, making it well suited for the 3-D graphical controls used by the DCIDS. The Macintosh uses a graphics based operating system that is ideal for user interface prototyping. A single button mouse is the standard input device, but other input devices such as trackballs are easily installed.

The prototype software is written by using SuperCard from Silicon Beach Software, Inc. This is a graphical software development tool that has built-in editing, scripting, and run-time support features. SuperCard readily supports the iterative process of designing, testing, and revising user interface designs. The completed design is then converted to a stand-alone program that does not require the development support environment of SuperCard.

A significant attribute of any user interface is the interaction of the user with the display and input devices. This interaction obviously cannot be portrayed adequately in a written report. A video report [4] is being prepared that demonstrates the various features of the DCIDS. The videotape shows the ease of use of the DCIDS to display and control all the aspects of shipboard damage control described in this report.

FUTURE CONSIDERATIONS

The current implementation of the DCIDS display uses a stored bit image of the ship's deck plans for its screens. Future plans for improved deck plan displays includes zoom, pan, and variable detail capabilities. Zoom capabilities would allow the operator to get a closer look at specific areas of the ship.

Panning would then be required to position the display at the desired location. Different detail would be displayed at the different scales to prevent cluttering at large scales but permitting close investigation of small details. This would be useful for information such as hatch closures that would not be visible on the large scale display but would be readily available at smaller scales.

Damage control officers often make handwritten notes on damage control diagrams as standard procedure or for their own reference. The ability to add this type of annotation to the DCIDS display would be helpful in many situations. Both text and drawing tools would be needed to permit messages and sketches to be overlaid on the various screens.

Any user interface design for systems this complex would benefit from some form of on-line help. Help may be as simple as a description of the functions of the buttons or it may be as complicated as the recommended configuration of smoke detectors depending on their location in the ship or type of compartment they are in. On-line help would prevent the operator from having to "read the manual" to learn how to perform his duties.

Information that will be stored on shipboard databases in the future may be useful for damage control operations. Inventories and stores of equipment or supplies that could be searched and retrieved through an interface with the DCIDS would provide helpful auxiliary functions.

The effective use of the fire mains system requires accurate knowledge of the integrity of the system. Fire main ruptures are currently reported verbally or are surmised from low pressure readings from the few pressure gauges. It would not be difficult to graphically display the pressure in every section of the fire mains if additional pressure gauges were installed. Ideally, a gauge between every pair of valves would provide a complete and accurate picture of the integrity of the system.

The use of decision aids could further improve the response to damage scenarios. Aids such as information derived from expert systems or fire propagation models would provide recommendations to the operator as to how to combat fires most effectively, or what steps should be taken to prevent the spread of fire. These efforts are under way under separate tasking, and their incorporation into the DCIDS would produce a complete integrated approach to effective damage control management.

CONCLUSIONS

Damage control sensor technology is advancing at a rapid pace, and an effective method of displaying information and controlling equipment is required. The DCIDS employs a graphical user interface that improves the performance of damage control personnel through intuitive, easy to use graphical displays and controls. The DCIDS provides a powerful tool that will fill the future needs of the Navy's damage control community.

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